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SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

A SCIENCE SERVICE PUBLICATION

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GOLDEN BULL FROM UR

Latest Relics From Abraham's Home Town

(See page 2)

Vol. XIV No. 378

New Gearless Auto Saves Fuel

Engineering

A new transmission for automobiles that eliminates shifting gears and automatically changes speeds was described to the Society of Automotive Engineers by its inventor, D. Sensaud de Lavaud, a French engineer.

Automobiles run on the streets of Paris fitted with this new transmission have convinced M. de Lavaud that his device is not only sound technically but can be applied commercially to motor vehicles. Development of the transmission has required seven years.

Because with ordinary gear-shift cars the driver never operates continuously at the most efficient relation between speed of engine and wheels, M. de Lavaud claimed that the automatic transmission will increase the average speed possible and effect a fuel saving of more than 20 per cent. in general, and some 40 per cent. in the dense traffic areas of cities.

A long transmission shaft is driven directly from the engine and rotates an inclined "inertia hub," which changes the rotation of the shaft into reciprocating motion. Connecting the inertia hub with the drive of the rear axle are rods which, by acting on roller ratchets, translate the back and forth thrusts into rotary motion applied by the axles to the wheels. The trick of the transmission consists in the variation of the inclination of the inertia hub with the engine torque and road resistance which automatically varies the throw of the connecting rods, consequently the rotation of the wheels and the speed of the car. This automatic transmission is combined with a gearless differential and a planetary reverse-gear located on the rear axle.

Advantages of his automatic transmission over gear transmission are listed by M. de Lavaud as follows:

Ordinary down grades can be negotiated, even with full throttle, without noticeably changing the speed of the engine.

It is impossible on level stretches or on upgrades to accelerate the engine beyond normal speed for the transmission.

Stalled engines are impossible.

The power of the automobile is controlled entirely by the throttle.

Acceleration, particularly to usual speeds, is much better than with gear transmission.

The car coasts freely downhill.

New Relics from Ur

Archæology

The latest news from Ur of the Chaldees, the city that is famous as having been the home of Abraham, is shown in the two pictures on the cover. Two of the 5000-year-old relics dug up by the joint expedition of the British Museum and the Museum of the University of Pennsylvania are represented. They were found during the season of 1927-28. After a division of the finds had been made with the Irak Museum, the remainder were sent to the British Museum in London, where they were cleaned and photographed. They are now on exhibition there for the summer, after which another division will be made, and the University Museum's share will come to Philadelphia.

The head of the bearded bull is from a statue made of thin gold over wood, with the hair, beard, eyes and tips of horns of lapis lazuli. The beard is thought to be a religious symbol whereby the animal sacrificed was identified with the god in whose honor the sacrifice was made, so that those who ate of its flesh would be in communion with the deity.

The background shows probably the original checker-board. It is a gaming board found in one of the tombs, along with the men—sets of round pieces of shells with lapis and gold dots.

In This Issue—

The end of the *gear-shift?* p. 2—Around, and *around,* and around, p. 3—Distant heating plant, p. 5—Understanding the *mind,* p. 6—Where to find it, after p. 6—Removing *stains,* p. 7—Not *Lon Chaney,* but really an insect, p. 7—What *may* happen, p. 8—Modern Marvels, p. 8—*Back* and forth, p. 9.

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INTERPRETING week by week, the latest developments in the various fields of science, this magazine attempts also to present its articles in the most pleasing and readable topography and the most convenient arrangement.

The *clippability, indexing,* and *automatic dating* of each article are unique features.

This is a *separable* magazine. Each original article can be clipped or torn out without losing or damaging another important article on the other side. These original articles are backed by reprinted quotations or excerpts, short one-sentence items, advertisements, and other material not likely to be clipped and preserved.

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All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

Why Lost People Go in Circles

Physiology

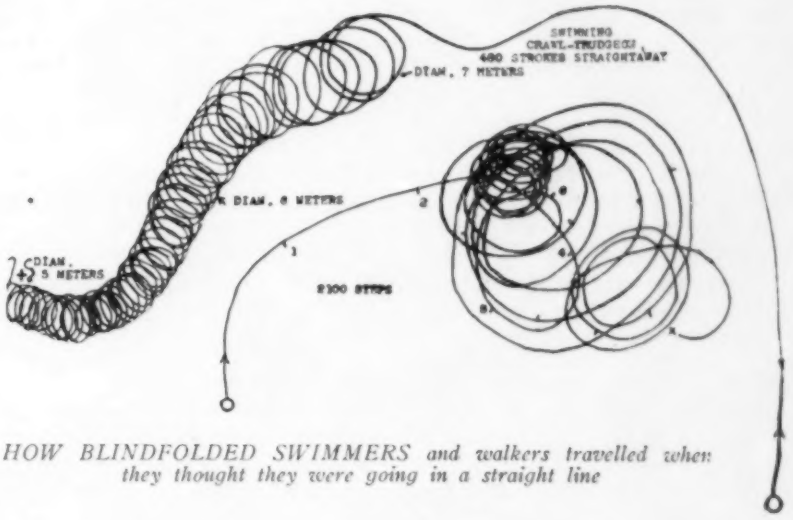
By Emily C. Davis

With your eyes shut, could you walk in a straight line across a big level field? Probably not, for in experiments on blindfolded walkers and automobile drivers, not one single person succeeded in taking himself where he intended to go.

Instead, the blindfolded persons went wandering across the field in spiral paths, making smaller and smaller circles as they continued to wander, corkscrew fashion. Pictures of their meanderings look like a child's scrawling attempts to draw smoke curling out of a chimney.

As a result of 300 of these blindfolded steering experiments. Dr. Asa A. Schaeffer, zoologist of the University of Kansas, has at last explained why people lost in the woods or desert go around in hopeless and frantic circles, and why blindfolded people have such hilarious difficulty in pinning the tail on the donkey at parties, even in a small room. More important than that, to the zoologist, he has demonstrated the existence of a steering mechanism in the entire world of animals and men that makes them turn in spirals when it gets control of a situation—a sort of "sixth sense" that most people have never dreamed that they possess.

Dr. Schaeffer was started off on this investigation by one of the smallest animals in existence, a single-celled ameba swimming in a glass of clear water. For several hours he observed the curving path taken by the tiny organism, and he became curious to know whether other animals, and men too, are compelled to travel a crooked path in life if eyes and other senses fail to steer them.



HOW BLINDFOLDED SWIMMERS and walkers travelled when they thought they were going in a straight line

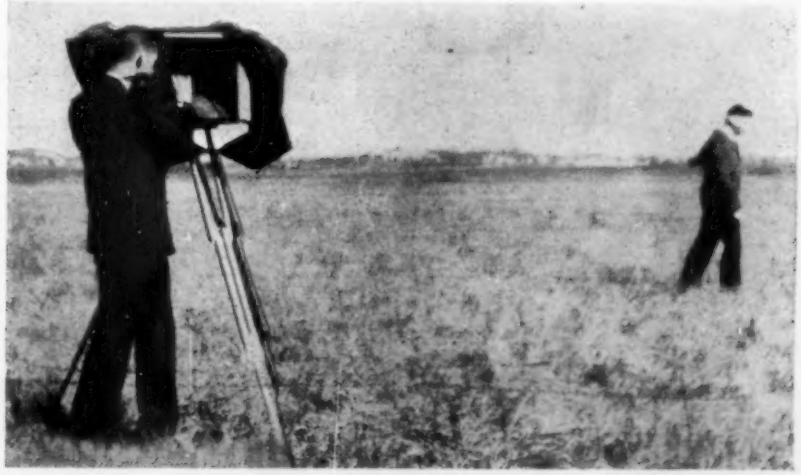
After a light snowfall, the zoologist and several students went out to a race track, and each one set out blindfolded to walk in a straight line across the unbroken snow. To their surprise, when they studied the tracks in the snow, each path formed a clock-spring spiral of great regularity. Sometimes an individual started off in a comparatively straight walk, but the path soon veered to right or left, and after that it never regained its original straightforwardness.

Some of the walkers circled to the right. Some circled left. Some varied occasionally. But generally an individual kept turning in the direction first taken when he started on a blindfold trip.

Dr. Schaeffer continued the experiments. He took students and instructors out on big level fields in Kansas and Colorado and set them to walking blindfold, and recorded the spiral paths they took. He turned a Ford coupé loose on a Kansas prairie with a series of blindfold drivers, or sometimes with a blindfold person sitting beside the driver and directing the route, and the paths chosen by the steerers were more spirals. He had blindfolded swimmers dive into the water and try to swim straight ahead, using various strokes, and diagrams of their swimming, carefully recorded, showed the same clock-spring spirals that were becoming so familiar.

The paths taken by small swimming creatures were also studied by the zoologist. He found that even animals that seem to swim erratically and in unusual fashions, such as small jelly fish, young king crabs, tadpoles and sea worms, all swam in spirals.

In the experiments with men he attempted to shut off guidance from the eyes, ears, and other senses to reduce a human being more or less to the same level as the simple lower animals. If the sun was bright, the blindfolded walker carried an umbrella to shut off any clues that might be given by the heat and light of the sun. If a breeze was blowing, a coat was sometimes wrapped around his head to prevent the wind from blowing on his face and thus giving *(Turn to next page)*



RECORDING THE PATH of a blindfolded walker

Why Lost People Go in Circles—*Continued*

a direction clue to his sense of touch. To keep his mind occupied as uniformly as possible, the walker was asked to count his steps as he moved toward his goal.

After a number of tracks were recorded, it became evident that the same mechanism which caused the clock-spring spirals in the experiments also cause the "circles" when persons lose their way. The lost person's eyes simply become useless as orientating organs for distance.

The Emperor Jones, in Eugene O'Neill's play, went plunging through the African forest, heading, as he believed, straight for the coast and safety. He told himself that it was queer the tom-toms kept drumming in his ears as loudly as ever, as he struggled on, but he never realized that his eyes had failed as guides and he was circling around his enemies.

"Similarly," Dr. Schaeffer explains, "wild game, when hard pressed, run in circles because fear overcomes the orienting power of the eyes and nose and then the spiraling mechanism leads them in 'circles.'

"This investigation is, therefore, not only a contribution toward explaining a deep-seated and widespread biological phenomena, but also an explanation for a bit of folklore about the paths of persons who lose their way and of game that is hard pressed in the chase."

Circles made by persons losing their way are much larger than the experimental circles with the eyes shut, he explains. With the eyes open, it is possible to walk in straight stretches as far as one can see clearly, which may be 30 or 60 feet in a snowstorm or fog, or several hundred feet in a forest. Then the lost person pauses, wonders which way he ought to go, and sets off again. The circles that are made in such circumstances are really polygons, irregular paths in which the person walks a straight line for a short distance, then turns at an angle and proceeds on around the "circle." The circles walked by a man lost in the desert or forest may have a circumference of 15 or even 50 miles, according to some accounts.

The belief that persons who lose their way go around in circles is deeply ingrained in folklore of many races, from the Hindu to the Norwegian and from the Chinese to the American.

There is evidence that European cave-dwellers of the Old Stone Age held the same belief, for the ancient hunters left behind them a reindeer antler with well-drawn clock-spring spirals carved on it, the oldest record of a clock-spring spiral carved by man.

The traditional explanation of why lost people do go in circles is as widespread as the belief itself. The answer always given is that, of course, a person turns to the right, or to the left, because one leg is stronger or longer than the other, so that leg takes a slightly longer step.

Biologists have taken measurements of arms and legs to prove that they do not match in the average human being. Their figures indicate that 95 to 99 per cent. of a group of people is likely to be right-handed. Seventy-five per cent. of them will have longer right arms. And 72 per cent. will have stronger right arms, according to pulling tests made with a dynomameter. Fifty-two per cent. will have longer left legs, and 52 per cent. will have stronger left legs.

But strangely enough, no one has ever recorded the paths taken by lost or blindfolded persons to see whether a man with a long right leg really does veer to the left as his long right leg carries him farther along than his short left leg does.

Dr. Schaeffer's experiments clear up this point by showing that there is no connection between a right-handed or right-legged person and the direction of the turns he is likely to make. A number of right-handed persons drove an automobile blindfolded. Some curved right and some left. In one test, which proved rather conclusively that the form of the body does not explain the circling, subjects were asked to walk forward 50 steps and then backward 50 steps, then forward again. If the longer leg, or some other one-sided feature of the body really steered the body to one side, then when the individual reversed and walked backward, the curve should be reversed. But this did not happen to any convincing extent.

From the variety of living things studied, the zoologist has concluded that spiral movement must be a universal property of moving, living matter. Experiments show that blindfolded college students and blindfolded mice swim in paths, very similar to the simplest water creatures that lack eyes and other senses completely.

One of the discoveries of the investigation is that pictures of paths made by a blindfolded person are decidedly individual in detail, and show something about his personality. People who concentrate easily on what they are told to do walk in smoother spirals and fall into the spiral path more quickly than others.

People of the plodding type who concentrate on one idea for a long time make paths consisting of long and regular series of spiral turns all in the same direction and gradually growing smaller, the diagrams show. Temperamental people, on the other hand, who change frequently from one idea to another, make open paths with few spiral turns, frequent reversals and many almost straight stretches.

It is possible, the zoologist believes, that further understanding of the connection between temperamental differences of this sort and the character of the paths may give a measuring stick for certain traits of personality. In other words, the shape and number of the spirals made by an individual may prove an index to the amount of certain traits that he possesses.

Spirals are much more common and important in nature than most people suppose. Even an organism as small as a spirochaete, only one two-thousandth of an inch long, has a spiraling mechanism hidden in its microscopic body. This germ produces the smallest spirals known in living matter.

Even to the world of atoms, the spiral is traced. Some of the atoms of which the universe is made are chained in spiral form.

An old mathematician once warned his followers that study of spirals could drive a man insane. Dr. Schaeffer says that this might be so if he pored too long over spirals expressed on paper in dizzy mathematical formulas. But the spirals of nature represent a fundamental force in man and animals which should be understood.

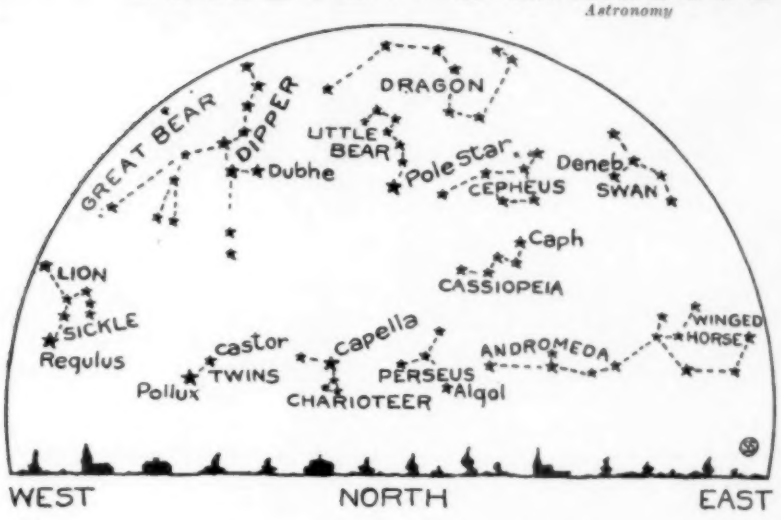
Science News-Letter, July 7, 1928

More than one-third of the people in the United States are without public library service.

The Army and Navy flying schools require that their students spend at least 300 hours flying.

Sun Now Farthest from Earth

Astronomy



By James Stokley

When you go on a picnic now and, perhaps, sweat in the hot sun, and wish that it was winter again, you may possibly gain some consolation from knowing that this is the time of year when the sun is farthest from us.

In fact, last January, to which in hot weather we are likely to look back with longing, the sun was more than three million miles closer to us than it is in July. July 4 was the date of the sun's "aphelion," as the astronomer calls the time when it is farthest from the earth. The "perihelion," when it was closest, happened six months ago, on January 4. Then it was 91,341,000 miles from us, but this month it has receded to 94,451,000 miles.

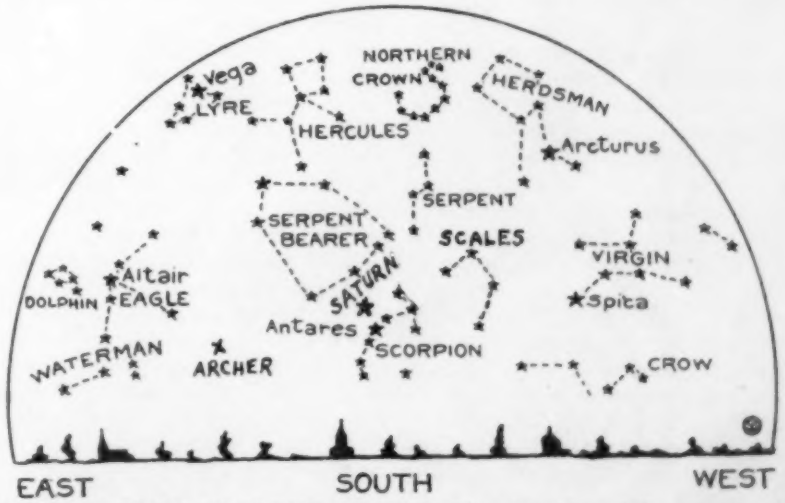
Well, then, one might ask, if the sun is several million miles farther away now than it was in January, and if, as we were taught in high school, its radiation gets less as the square of its distance increases, why don't we get less heat now instead of more? The answer is that now the sun is shining more squarely at us. Take a beam of sunlight (and also sunheat) a yard square. When the sun is directly overhead, this will cover a square yard of the earth's surface. When the sun is not directly overhead, the beam strikes the earth at an angle, and the same amount of heat may be spread over as much as several square yards of the earth's surface. At such times, a single square yard would only get a fraction of the heat that it gets when the sun is overhead. At this time of year the sun, though not overhead at any place in the United States, is more nearly so than in winter. Therefore, the earth is heated more, and so are the people on it.

But it is the evening skies that interest people in summer more than the sky of day. During the day we try to get in the shade, where we can see as little as possible of the sky, but at night the summer skies, especially if one has the proper companionship, are the cynosure of many eyes. For one thing, this is the time of year of moonlight excursions. July brings a full moon on Monday the second. Last quarter, when the moon rises in the east at midnight, comes on the tenth. New moon, when the moon is on line with the sun, occurs on the sixteenth. At this time the moon itself is invisible, but a few evenings later it appears as a slender crescent in the evening twilight. Then on succeeding evenings it waxes gradually, reaching first quarter, at which time the moon is directly south at sunset, on the twenty-fourth of the month. All this means that from about July 1 to July 5, and from July 22 for the rest of the month, the moon will be in the evening sky.

The only planet that is easily visible during the July evenings is Saturn. It is in the southern sky, as shown on the map, a short distance above, and to the east of Antares, the bright red star in the constellation of Scorpio, the scorpion. Saturn is considerably brighter than Antares, about a full magnitude, according to the astronomer's reckoning, and is also of a yellowish color. It shines with a steadier, more leaden, light than the star. Incidentally, the terming of its light "leaden" has historic significance, because the ancient alchemists, who identified various metals with the different planets, assigned lead to Saturn, doubtless because of its color.

The maps show the stars that can be seen during the July evenings. Vega, in the constellation of Lyra, the lyre, high in the eastern sky, is the most conspicuous. High in the western sky, in Bootes, the herdsman, is Arcturus, the next brightest. Altair, in Aquila, the eagle, is to the southeast, and ranks next. Spica, in Virgo, the virgin, low in the southwest; Antares in Scorpio, already mentioned, and Deneb, in Cygnus, the swan, to the northeast of Lyra, and lower in the sky, complete the half-dozen first magnitude stars that are with us these July evenings.

Science News-Letter, July 7, 1928



HOLD THESE MAPS IN FRONT OF YOU. The upper then shows you the northern and the lower the southern sky as it appears on July evenings

Understanding the Mind of Man

Psychiatry

DR. ADOLF MEYER of Johns Hopkins University in his presidential address before the American Psychiatric Association at Minneapolis:

We deal with the most unruly and willful part or aspect of man, the very organ or function of self-assertion, self-concern and self-protection. Mankind would like to be free from the scourges and their consequences without having to surrender the joys and habits that spread and engender them. It would like remedies for drug and alcohol addiction without having to give up its cravings and gratifications.

The same holds for the prevention of paresis and syphilis and the control and training of emotion and fancy that clash with reality, and for the craving for self-realization at any price in contrast to a sensible acceptance of a consensus. Understanding and handling these problems may not be everybody's job as little as teaching or research in the sciences or many other things which we let those do who have skill, time and experience. A psychiatrist has to have the most comprehensive knowledge of the human organism and also of its functions in complex personal and social relations, past, present and future.

Anyone who thinks that Watson's accounts of behaviorism cover all that arises in our field has difficulty in understanding the meaning of psychiatry, mental hygiene, psychopathology and neurology.

Those who imagine that all psychiatry and psychopathology and therapy have to resolve themselves into the smattering of claims and hypotheses of psycho-analysis and that they stand and fall with one's feelings about psycho-analysis are equally misguided.

I sometimes feel that Einstein with all his concern in the relativity in astronomy has to deal with very simple facts as compared to the complex and erratic and multi-contingent performance of the human microcosmos, the health, happiness and efficiency of which we psychiatrists are concerned with.

Man has at last begun to see himself as part of Nature and he demands that the scientist include in his view of Nature also what we know of man. We recognize that we are organisms that start under very definite conditions and represent a curve of life, of growth to a more or less complete maturity with a wealth of opportunity for doing our share, and in time a passing away. We blossom as individuals and sink back again into the larger flow of contemporaries and survivors in our family, our race, our nation and whatever we are just a part or a more or less thoughtful representative of.

In contrast to the practice of past ages, we do not start from mythological and philosophical absolutes, but single out concrete data of experience in whatever complexity we may find them. This does not necessitate any presumptions concerning final definitions and views of the ultimate nature of life and of consciousness and its contents, or of such topics or factors as religion, ideals and codes, ambitions and ethics, etc., or any final philosophies. . . .

In dealing with human facts with our limited concepts and expressions and capacity to think at once comprehensively and concretely, we cannot afford to disregard suggestive pointers or indicators or references and perspectives within reach; we have to seek and respect the more comprehensive topics and groups of facts which elementalism is apt to disregard or actually to shun, the data that some of us point to under the heading of integration and integrates, the data which are in the mind of the holist, to use General Smuts' term, and which Aristotle must have tried to include in his entelechies and what in practical life we call trends, possibilities, contingencies, etc.

As such suggestive rather than finished, contingent rather than finite topics and entities, I should mention what we call person and personality, character, tendencies, experiences, the intellectual, and active, and effective, and thought processes, primary and secondary symbolization, the crystallization of types, of life attitudes, of prospective and retrospective emphases, of the range of vision of the moment, and the balance of assets. We might single out behavior-situations of tangible and suggestive and sufficiently comparable nature, the general and temporary energy and action pressure of an organism or a person, and the inherited and acquired endowment, the extent to which the person reaches the capacity for constructive composure as well as the ability to muster the assets in emergencies (i. e., what we call judgment), the amount or extent of dependability (i. e., the character), the extent and type of the inclusion of others, singly and in groups, in the tendencies of action, in vision and thought and fancy, in play and work and in retrospect and prospect, and the amount of socialization as opposed to the mere self-concern and almost obsessive individualism so rampant today.

Science News-Letter, July 7, 1928

Marginal Peoples

Anthropology

ROLAND B. DIXON in *The Building of Cultures* (Scribner's):

We have seen that marginal peoples, those whom fate has placed in the far corners of the world, seem foredoomed to cultural poverty. But here, for peoples as for individuals, the factor of ability, of genius, of intellectual fibre enters in. For, just as a man born in poverty and destitute of advantages may, if he has the ability and the mettle, rise above these obstacles, seize opportunity, and achieve success, so may a whole people. And, as a man, although poor in material things, may yet become a great leader, so may a whole people. The little group of poor Semitic nomads who, as the Hebrews, fought their way into tiny Palestine and settled on its rocky hills, wrung from this hard environment a culture poor indeed in material things, but so rich in thought and in its conception of life, that it has profoundly influenced the history of the world. The little clan of the Inca, from their high, cup-like valley of Cuzco, hemmed in by forest and bleak *paramo*, reached out and grasped an empire almost as great in extent as that of Rome, and evolved a scheme of government which almost completely realized the socialist Utopia, not dreamed of in Europe for many a hundred years. The Japanese in their rocky archipelago took in the seventh century of the best that China had to offer and rebuilt their culture on a higher plane; and then in the nineteenth century reached half way around the world to Europe and did the same thing again.

Science News-Letter, July 7, 1928

Wild silk is used in China to make pongee.

There are 1,400 different kinds of mosquitoes.

Glances at New Books

Sir Isaac Newton—F. E. Brasch, Editor—*Williams and Wilkins* ($5). Last year there was celebrated throughout civilized countries the bicentenary of the death of Sir Isaac Newton, for in the two centuries that have since elapsed the work of the great English scientist has penetrated all political borders, and won him a place as a star of the first magnitude in scientific history. The chief American celebration was held last autumn in New York by the History of Science Society, with the cooperation of other scientific organizations. The papers presented at the meeting by David Eugene Smith, Dayton C. Miller, George D. Birkhoff, William W. Campbell, Michael I. Pupin, Florian Cajori and others, on various aspects of Newton's work, are now gathered together in permanent form. In the appendix is a catalog of the exhibit of Newtoniana held in conjunction with the meeting, and which gives an idea of the wealth of such material that has come to the United States. As usual with publications of Williams and Wilkins, the book is typographically up to the highest standards.

History of Science
Science News-Letter, July 7, 1928

The Essence of Architecture—William Roger Greeley—*Van Nostrand*. A concise and interesting little book that gives just what the title says that it does. It is a bit surprising to Science Service, however, to see the building of the National Academy of Sciences and the National Research Council, in which it has its home, referred to as the "Academy of Arts and Sciences."

Architecture
Science News-Letter, July 7, 1928

Elements of Astronomy—Edward Arthur Fath—*McGraw-Hill* ($3). In the second edition of this very good text Dr. Fath has included new astronomical discoveries up to the end of 1927. A set of new star maps, and minor changes in accord with various criticisms, all go to making this even better than the first edition. This book is one of several published in the last few years that have remedied the lack of a good elementary text in astronomy, a state of affairs that existed about 1922.

Astronomy
Science News-Letter, July 7, 1928

Cloth Clue to History

Archæology

A few little pieces of cloth threaten to revolutionize present-day ideas of Greek history. The pieces of cloth, representing a knight or a khan, were among the collection brought from Mongolia by the Russian explorer, Col. Peter Kozlov. Archæologists who have examined them declare that they confirm the fact that Greek culture penetrated eastward to that remote region in ancient times.

Believing the discovery to be of great significance, the Academy of Sciences of the Soviet Union has had ten copies of the original pieces of cloth made, and has sent the original exhibits to Prof. P. Pelliot, of the College of France, authority on the archæology of central Asia.

Science News-Letter, July 7, 1928

Cause of Stains Discovered

Chemistry

Methods of removing the brown stain that often disfigures Indiana limestone used for building facing and trim were announced to the American Society for Testing Materials by Lee Huber, research engineer of Bedford, Ind.

A jet of steam played on the stain followed by bathing with 5 per cent. formic acid solution is one cure. A poultice moistened with a 5 per cent. solution of sodium carbonate also gives results.

Mr. Huber traced the stain to seepage from the cement used to back the stone. Prevention of the stain is aided by the use of white portland cements.

Science News-Letter, July 7, 1928

"Annealed" Meat

Physics

British brains have been hard at work to make palatable the famous roast beef of England, that has to come in these degenerate days all the way from Australia or South America.

The freezing process necessary to carry the meat on its long journey dries up all the natural juices. It has been found, however, at the Low Temperature Research Station at Cambridge that when beef is frozen and thawed very slowly, practically no fluid is lost. In one experiment the time consumed in freezing and thawing took nearly 80 days at the end of which the meat was hardly distinguishable from fresh. If this method can be applied in industry, it will be of considerable commercial importance, it is believed.

Science News-Letter, July 7, 1928

Nature Ramblings

By Frank Thone

Natural History

Specters

Wanderers in the summer woods, or even sitters in summer pergolas and arbors are frequently startled at the sudden appearance of a long-legged live twig deliberately stalking up their arms or necks. Nervous people may be shocked, and even stouter individuals will not be able to resist a creepy sensation at the sight of this weird insect. Its entomological name, "phasmid," is an acknowledgment of its rather unearthly appearance, for it is derived from a Greek word that means apparition or phantom.

But the walking-stick need not cause any alarm, for it is quite as impotent for harm as any other phantom. The phasmids are relatives of the grasshoppers, little though they may look like their livelier cousins. The family is mainly tropical, but at least one species ventures north, and is common throughout most of the northern states. Walking-sticks are much more numerous than they appear to be, for even the most careful observers are easily deceived by their twig-like appearance. Only a few of the southern forms have even short wings.

These insects are like many other of the lower animals that are unable to defend themselves from attack, in that they can easily detach a limb if it is seized, and hobble off on the four or five remaining ones. They can also grow legs to replace such losses, though the new members are usually smaller and weaker than the original legs.

Science News-Letter, July 7, 1928

Green olivines found in the lava flows of Hawaii are known in the islands as Hawaiian diamonds.

Our Present-Day Wonders

General Science

WALTER S. GIFFORD, president of the American Telephone and Telegraph Company, in a commencement address at Cooper Union (New York):

Reading the morning paper the other day I noted that a dirigible had crossed over the North Pole; a rocket auto was said to have gone faster than two miles a minute and it was predicted that a flight around the world might be made in twelve hours.

Colonel Lindbergh, as chairman of the Technical Committee of an air transport company, was reported as saying that he would do all that is needed of him toward the starting of an air-rail line across the continent.

A demonstration was made of a broadcast of pictures by radio; a prominent doctor stated that he could foresee 150 years of life resulting from expected developments of medical science. A prominent psychologist urged the building of special hospitals which, he claimed, could solve the problems of mental maladjustments.

The United States Army announced that in its tests for gas masks it had developed a new process for extending the life of rubber under normal storage conditions from a few years to thirty-five years.

This is just a somewhat casual survey of a single morning's newspaper. While all of the things mentioned may not materialize, it seems to me indicative of the day and age in which we are now living.

It is sometimes a habit of younger people to feel that all of the worthwhile things have been done and that there is no opportunity open for them such as was open to the preceding generation. I am convinced that never before in history have the younger people of the world faced greater opportunities.

We are, in fact, engaged today in the development of a civilization based on the conquest of nature rather than the conquest of human beings. What we succeed in winning benefits every one and, obviously, the field for conquest is unlimited.

Already the results of this conquest which is scarcely begun have raised the standard of living in this country, so that it is no longer necessary for the mass of people to work twelve or fourteen hours a day. We no longer have in the cities the slums and destitution that we had a relatively short time ago.

In place, we hear of a cultural wage rather than a living wage. We have leisure such as was hardly imagined possible and with it the opportunity for self-development and enjoyment, not limited to a few people but for all, except perhaps those who are physically or mentally incapacitated.

It is true that times change and with them change the requirements that make for success in life. Success in life to the individual in the days of ancient Rome was undoubtedly a different thing from success in life today. Moreover, opportunities for success then were limited to a very few. Today, in this country at least, they are open to all.

Although this has been called a materialistic age, achievement curiously enough is based more than it ever has been on devotion to an ideal. The ideal that has always been the inspiration of the professional worker and scientist—the ideal of service that has been dominant with teachers and professors in schools and colleges—has been adopted by business and is essential to success in business. . . .

It is a glorious time to live—a time when a single morning's paper comments casually on events, any one of which a century or two ago would have been sufficiently important for you and me to have studied about it in history.

Science News-Letter, July 7, 1928

The Future of Mankind

General Science

J. B. S. HALDANE in *Possible Worlds* (Harper's):

It is quite likely that, after a golden age of happiness and peace, during which all the immediately available benefits of science will be realized, mankind will very gradually deteriorate. Genius will become ever rarer, our bodies a little weaker in each generation; culture will slowly decline, and in a few thousand or a few hundred thousand years—it does not much matter which—mankind will return to barbarism, and finally become extinct. If this happens I venture to hope that we shall not have destroyed the rat, an animal of considerable enterprise which stands as good a chance as any other of evolving towards intelligence.

In the rather improbable event of man taking his own evolution in hand—in other words, of improving human nature, as opposed to environment—I can see no bounds at all to his progress. Less than a million years hence the average man or woman will realize all the possibilities that human life has so far shown. He or she will never know a minute's illness. He will be able to think like Newton, to write like Racine, to paint like Fra Angelico, to compose like Bach. He will be as incapable of hatred as St. Francis, and when death comes at the end of a life probably measured in thousands of years he will meet it with as little fear as Captain Oates or Arnold von Winkelried. And every minute of his life will be lived with all the passion of a lover or a discoverer. We can form no idea whatever of the exceptional men of such a future.

Man will certainly attempt to leave the earth. The first voyagers into interstellar space will die, as did Lilienthal and Pilcher, Mallory and Irvine. There is no reason why their successors should not succeed in colonizing some, at least, of the other planets of our system, and ultimately the planets, if such exist, revolving round other stars than our sun. There is no theoretical limit to man's material progress but the subjection to complete conscious control of every atom and every quantum of radiation in the universe.

But, whether any of these possibilities will be realized depends, as far as we can see, very largely on the events of the next few centuries. If scientific research is regarded as a useful adjunct to the army, the factory, or the hospital, and not as the thing of all things most supremely worth doing, both for its own sake and that of its results, it is probable that the decisive steps will never be taken. And unless he can control his own evolution as he is learning to control that of his domestic plants and animals, man and all his works will go down into oblivion and darkness.

Science News-Letter, July 7, 1928

CLASSICS OF SCIENCE: An Ancestor of the Electric Motor

Physics

The mechanical toy here described by the first secretary of the Smithsonian Institution utilizes the principle of the electric motor. It will be easy for you, after duplicating it, to design a toy motor with a spinning motion instead of a reciprocating one for the magnet, for you have seen such machines and know their utility. In Joseph Henry's day there was no possibility of electricity being produced on a scale great enough to do useful work, and so he carried his discovery no further than to note the curious fact that mechanical motion can be obtained from magnetism.

SCIENTIFIC WRITINGS OF JOSEPH HENRY: On a reciprocating motion produced by magnetic attraction and repulsion. (Silliman's American Journal of Science, July, 1831, vol. XX, pp. 340-343).

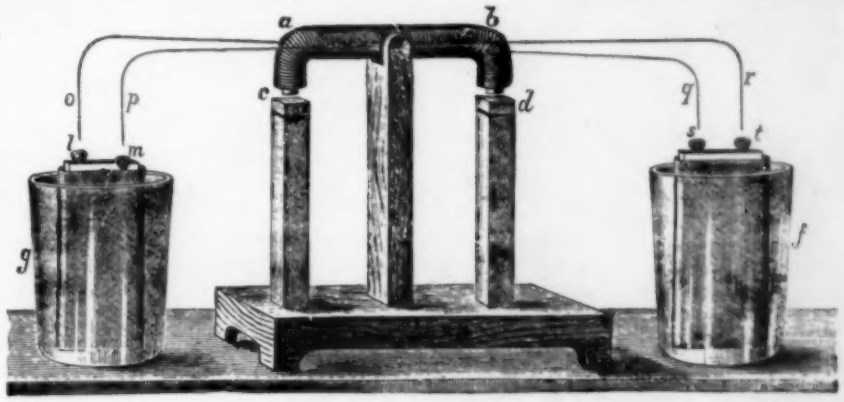
To the Editor:

SIR:—I have lately succeeded in producing motion in a little machine by a power which, I believe, has never before been applied in mechanics—by magnetic attraction and repulsion.

Not much importance, however, is attached to the invention, since the article, in its present state, can only be considered a philosophical toy; although, in the progress of discovery and invention it is not impossible that the same principle, or some modification of it on a more extended scale may hereafter be applied to some useful purpose. But without reference to its practical utility and only viewed as a new effect produced by one of the most mysterious agents of nature, you will not, perhaps, think the following account of it unworthy of a place in the *Journal of Science*.

It is well known that an attractive or repulsive force is exerted between two magnets, according as poles of different names or poles of the same name are presented to each other.

In order to understand how this principle can be applied to produce a reciprocating motion, let us suppose a bar magnet to be supported horizontally on an axis passing through the center of gravity, in precisely the same manner as a dipping needle is poised; and suppose two other magnets to be placed perpendicularly, one under each pole of the horizontal magnet, and a little below it, with their north poles uppermost; then it is evident that the south pole of the horizontal magnet will be attracted by the north pole of one of the perpendicular magnets, and its north pole repelled by the north pole of the other: in this state it will remain at rest, but if, by any means, we reverse the polarity of the horizontal magnet, its position will be changed and the extremity, which was before attracted, will now be repelled; if the polarity be again reversed, the position will again be changed, and so on indefinitely: to produce, therefore, a continued vibration it is only necessary to introduce into this arrangement some means by which the polarity of the horizontal magnet can be instantaneously changed, and that too by a cause which shall be put in operation by the motion of the magnet itself; how this can be effected will not be difficult to conceive when I mention that instead of a permanent steel magnet in the movable part of the apparatus a soft iron galvanic magnet is used. (Professor Henry's "method of constructing the galvanic magnet on an improved plan" is reprinted below.)



[Electro-magnetic Engine.]

Prof. Henry's Original Diagram

The change of polarity is produced simply by soldering to the extremities of the wires which surround the galvanic magnet, two small galvanic batteries in such a manner that the vibrations of the magnet itself may immerse these alternately into vessels of diluted acid; care being taken that the batteries are so attached that the current of galvanism from each shall pass around the magnet in an opposite direction.

Instead of soldering the batteries to the ends of the wires, and thus causing them at each vibration to be lifted from the acid by the power of the machine, they may be permanently fixed in the vessels, and the galvanic communication formed by the amalgamated ends of the wires dipping into cups of mercury.

The whole will be more readily understood by a reference to the annexed drawing: *a b* is the horizontal magnet, about 7 inches long, and movable on an axis at the center: its two extremities when placed in a horizontal line, are about 1 inch from the north poles of the upright magnets *c* and *d*. *g* and *f* are two large tumblers containing diluted acid, in each of which is immersed a plate of zinc surrounded with copper. *l, m, s, t,* and 4 brass thimbles soldered to the zinc and copper of the batteries and filled with mercury.

The galvanic magnet *ab* is wound with 3 strands of copper bell-wire, each about 25 feet long; the similar ends of these are twisted together so as to form two stiff wires, which project beyond the extremity *b*, and dip into the thimbles *s, t*.

To the wires *q, r,* two other wires are soldered so as to project in an opposite direction, and dip into the thimbles *l, m*. The wires of the galvanic magnet have thus, at it were, four projecting ends; and by inspecting the figure it will be seen that the extremity *p*, which dips into the cup *m* attached to the copper of the battery in *g* corresponds to the extremity *r* connecting with the zinc in *f*.

When the batteries are in action, if the end *b* is *(Turn to next page)*

An Ancestor of the Electric Motor—*Continued*

depresesd until *q, r* dips into the cups *s, t, ab* instantly becomes a powerful magnet, having its north pole at *b;* this, of course, is repelled by the north pole *d*, while at the same time it is attracted by *c*, the position is consequently changed, and *o, p* comes in contact with the mercury in *l, m;* as soon as the communication is formed, the poles are reversed, and the position again changed. If the tumblers be filled with strong diluted acid, the motion is at first very rapid and powerful, but it soon almost entirely ceases. By partially filling the tumblers with weak acid and occasionally adding a small quantity of fresh acid, a uniform motion, at the rate of 75 vibrations in a minute, has been kept up for more than an hour: with a large battery and very weak acid, the motion might be continued for an indefinite length of time.

The motion here described is entirely distinct from that produced by the electro-magnetic combination of wires and magnets; it results directly from the mechanical action of ordinary magnetism: galvanism being only introduced for the purpose of changing the poles.

My friend, Prof. Green, of Philadelphia, to whom I first exhibited this machine in motion, recommended the substitution of galvanic magnets for the two perpendicular steel ones. If an article of this kind was to be constructed on a large scale, this would undoubtedly be the better plan, as magnets of that kind can be made of any required power; but for a small apparatus, intended merely to exhibit the motion, the plan here described is, perhaps, the most convenient.

Constructing Galvanic Magnet

A round piece of iron, about ¼ of an inch in diameter, was bent into the usual form of a horse-shoe, and instead of loosely coiling around it a few feet of wire, as is usually described, it was tightly wound with 35 feet of wire, covered with silk, so as to form about 400 turns; a pair of small galvanic plates, which could be dipped into a tumbler of diluted acid, was soldered to the ends of the wire and the whole mounted on a stand. With these small plates, the horse-shoe became much more powerfully magnetic than another of the same size, and wound in the usual manner by the application of a battery composed of 28 plates of copper and zinc, each 8 inches square. Another convenient form of this apparatus was contrived by winding a straight bar of iron 9 inches long with 35 feet of wire, and supporting it horizontally on a small cup of copper containing a cylinder of zinc—when this cup, which served the double purpose of a stand and the galvanic element, was filled with dilute acid, the bar became a portable electro-magnet. These articles were exhibited to the Institute in March, 1829.

The idea afterwards occurred to me, that a sufficient quantity of galvanism was furnished by the two small plates, to develope, by means of the coil, a much greater magnetic power in a larger piece of iron. To test this, a cylindrical bar of iron, ½ an inch in diameter, and about 10 inches long, was bent into the form of a horse-shoe, and wound with 30 feet of wire; with a pair of plates containing only 2½ square inches of zinc, it lifted 14 lbs. avoirdupois. At the same time, a very material improvement in the formation of the coil suggested itself to me, on reading a more detailed account of Prof. Schweigger's galvanometer, and which was also tested with complete success upon the same horse-shoe; it consisted in using several strands of wire, each covered with silk, instead of one:—agreeably to this construction, a second wire, of the same length as the first, was wound over it, and the ends soldered to the zinc and copper in such a manner that the galvanic current might circulate in the same direction in both, or in other words, that the two wires might act as one; the effect by this addition was doubled, as the horse-shoe, with the same plates before used, now supported 28 lbs.

With a pair of plates 4 inches by 6 inches, it lifted 39 lbs., or more than 50 times its own weight.

These experiments conclusively proved that a great development of magnetism could be effected by a very small galvanic element, and also that the power of the coil was materially increased by multiplying the number of wires, without increasing the length of each.

The multiplication of the wires, increases the power in two ways; first, by conducting a greater quantity of galvanism, and secondly, by giving it a more proper direction, for since the action of a galvanic current is directly at right angles to the axis of a magnetic needle, by using several shorter wires, we can wind one on each inch of the length of the bar to be magnetized, so that the magnetism of each inch will be developed, by a separate wire; in this way the action of each particular coil becomes very nearly at right angles to the axis of the bar, and consequently, the effect is the greatest possible. This principle is of much greater importance when large bars are used. The advantage of a greater conducting power from using several wires might in a less degree be obtained by substituting for them one large wire of equal sectional area, but in this case the obliquity of the spiral would be much greater and consequently the magnetic action less; besides this, the effect appears to depend in some degree on the number of turns which is much increased by using a number of small wires.

Joseph Henry was born December 17, 1797, in Albany, N. Y., and died in Washington, D. C., May 13, 1878. His instincts were decidedly scientific, and he studied chemistry, anatomy and physiology with the idea of becoming a physician. At the age of 27 he began to publish researches in chemistry and mechanics, and the next year he was appointed assistant engineer to survey a route for a state road from the Hudson River to Lake Erie. This experience inclined him to become a civil engineer. But in 1826 he was elected professor of mathematics and natural philosophy at Albany Institute, and from that time he devoted himself to research on "electricity and galvanism," or static and dynamic electric phenomena. His discoveries supplement those of Faraday in the history of the development of our knowledge of electricity. His interests were still broad in the field of science, however, for in 1844 he was studying cohesion in solids and liquids with soap bubbles and ice, and the next year he was measuring the difference in radiation from sun-spots and the general surface of the sun. In 1835 the Congress of the United States had been startled to discover that it was the trustee of a considerable fortune left by James Smithson, a disgruntled English chemist, to found in the promising New World "an institution for the increase and diffusion of knowledge." In 1846 the Smithsonian Institution was organized, and Joseph Henry was elected its first Secretary and director. As part of the work of the Institution he initiated weather forecasts based on telegraphic news of meteorological conditions throughout the country. He was also actively interested in the American lighthouse system. He was elected president of the National Academy of Sciences annually from 1868 until his death ten years later.